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ANDERSON ENGINEERING INC SPRINGFIELD MO
NATIONAL DAM SAFETY PROGRAM. BIGB DAM (MO 10231), MISSISSIPPI ---ETC(U)
DEC 78 J M HEALY, S L BRADY

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MISSISSIPPI - SALT - QUINCY BASIN

BIBB DAM

PIKE COUNTY, MISSOURI

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PHASE I INSPECTION REPORT

6 NATIONAL DAM SAFETY PROGRAM.

Bibb Dam (MO 10231), Mississippi - Salt - Quincy
Basin, Pike County, Missouri. Phase I
Inspection Report.



⑨ Final rept.,

⑮ DACW43-78-C-0166

⑩ John M. /Healy Steven L. /Brady

PREPARED BY: U. S. ARMY ENGINEER DISTRICT, ST. LOUIS

FOR: STATE OF MISSOURI

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.		

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DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 NORTH 12TH STREET
ST. LOUIS, MISSOURI 63101

IN REPLY REFER TO

SUBJECT: Bibb Dam (Mo. 10231)

This report presents the results of field inspection and evaluation of the Bibb Dam (Mo. 10231).

It was prepared under the National Program of Inspection of Non-Federal Dams.

This dam has been classified as unsafe because of extensive seepage at the downstream toe and through the embankment and a seriously inadequate spillway that will pass only 10 percent of the Probable Maximum Flood without overtopping the dam.

SUBMITTED BY:

SIGNED
Chief, Engineering Division

22 FEB 1979
Date

APPROVED BY:

SIGNED
Colonel, District Engineer

23 FEB 1979
Date

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BIRB DAM
PIKE COUNTY, MISSOURI
MISSOURI INVENTORY NO. 10231

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Prepared By
Anderson Engineering, Inc., Springfield, Missouri
Hanson Engineers, Inc., Springfield, Illinois

For
The Governor of Missouri

December, 1978

PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam: Bibb Dam
State Located: Missouri
County Located: Pike County
Stream: Unnamed Tributary to Noix Creek
Date of Inspection: 28 September 1978

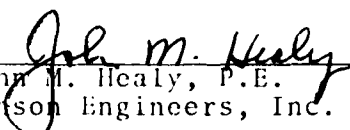
Bibb Dam was inspected by an interdisciplinary team of engineers from Anderson Engineering, Inc. of Springfield, Missouri and Hanson Engineers, Inc. of Springfield, Illinois. The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

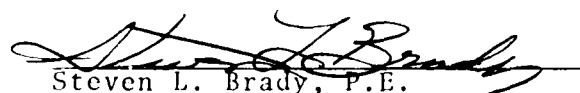
The guidelines used in the assessment were furnished by the Department of the Army, Office of the Chief of Engineers, and they have been developed with the help of several Federal and State agencies, professional engineering organizations, and private engineers. Based on these guidelines, this dam has been classified by the St. Louis District Corps of Engineers as an intermediate size dam with a high downstream hazard potential. Their estimate of the damage zone extends 6 miles downstream of the dam. Within the damage zone are four farmhouses and associated farm buildings, two improved roads and one state highway. The floodplain is farmed.

Our inspection and evaluation indicates that the combined spillways do not meet the criteria set forth in the guidelines for a dam having the above size and hazard potential. The combined spillways will pass 10 percent of the Probable Maximum Flood, without overtopping. The Probable Maximum Flood is defined as the flood discharge that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region. The guidelines require that a dam of intermediate size with a high downstream hazard potential pass 100 percent of the PMF. The 100-year frequency flood will overtop the dam. A 100-year flood is one that has a 1 percent chance of being exceeded in any given year.

Other deficiencies visually observed by the inspection team were: (1) seepage under the dam along much of the downstream toe and apparent seepage through the embankment at one point; (2) a thick cover of brush and trees; (3) erosion gullies on the south abutment; (4) animal burrows all along the downstream face; and (5) brush in the area of the spillway inlet and outlet areas. Another deficiency was the lack of seepage and stability analysis records. It is

recommended that the owners take the necessary action in the very near future to correct the deficiencies reported herein. A detailed discussion of these deficiencies is included in the following report.


John M. Healy, P.E.
Hanson Engineers, Inc.


Steven L. Brady, P.E.
Anderson Engineering, Inc.

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
BIBB DAM - ID No. 10231

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APPENDICES

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Vicinity Map
Plan and Section of Dam

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APPENDIX B

Overtopping Analysis - PMF

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APPENDIX C

Photographs of Dam, Lake and Watershed

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SECTION 1 - PROJECT INFORMATION

1.1 GENERAL:

A. Authority:

The National Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of safety inspection of dams throughout the United States. Pursuant to the above, the St. Louis District, Corps of Engineers, District Engineer directed that a safety inspection be made of Bibb Dam in Pike County, Missouri.

B. Purpose of Inspection:

The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and a visual inspection in order to determine if the dam poses hazards to human life or property.

C. Evaluation Criteria:

Criteria used to evaluate the dam were furnished by the Department of the Army, Office of the Chief of Engineers, "Recommended Guidelines for Safety Inspection of Dams." These guidelines were developed with the help of several federal agencies and many state agencies, professional engineering organizations, and private engineers.

1.2 DESCRIPTION OF PROJECT:

A. Description of Dam and Appurtenances:

Bibb Dam is an earth and rock fill structure approximately 45.5 ft high and 440 ft long at the crest. The appurtenant works consist only of three corrugated metal pipes which are located at the north abutment. Sheet 2 of Appendix A shows a plan of the embankment and spillways and a typical section of the embankment.

B. Location:

The dam is located approximately 1 1/2 miles north of Bowling Green in Pike County, Missouri on a small tributary of Noix Creek. The dam and lake are within the Bowling Green Missouri 15 minute quadrangle sheet (Sections 13 and 14), T53N, R3W-latitude 39° 22.0'; longitude 91° 11.8'). Sheet 1 of Appendix A shows the general vicinity.

According to letter from Mr. Philip R. Bibb, dated 19 March 1979,
Bibb Dam (Mo. 10231) is co-owned by:

Mr. Philip R. Bibb
220 E. Champ Clark Drive
Bowling Green, Missouri 63334

Mr. & Mrs. Earl B. Bibb
RFD #3
Bowling Green, Missouri 63334

Reverand & Mrs. Gideon I. Krein
P.O. Box 8
Biggsville, Illinois 61418

C. Size Classification:

With an embankment height of 45.5 ft and a maximum storage capacity of approximately 293 acre-ft, the dam is in the intermediate size category.

D. Hazard Classification:

The St. Louis District, Corps of Engineers has classified this dam as a high hazard dam. Their estimate of the damage zone extends 6 miles downstream of the dam. Within the damage zone are four farmhouses and associated farm buildings, two improved roads and one state highway. The floodplain is farmed.

E. Ownership:

The dam is owned by Mr. Phillip Bibb, 220 East College Street, Bowling Green, Missouri 63334.

F. Purpose of Dam:

The dam forms a 15 acre recreational lake.

G. Design and Construction History:

The dam was built in 1955 by the Bibb family. Information from a present city employee who helped build the dam) and the owner indicates that the dam was originally built up to approximately the present crest elevation from a mixture of soil and boulders (overburden from a nearby rock quarry). It was indicated that this material was placed in layers with bulldozers. It also was reported that this initial embankment did not impound water. The city employee indicated that a clayey material was then obtained from abutment and reservoir areas and placed as a 20 ft wide section along the entire upstream face of the dam. The owner has indicated that two 12 in. diameter corrugated metal pipes were installed in the north abutment when the dam was built. The owner indicated that the dam was overtopped four or five years ago (± 1973), and that a 15 in. diameter corrugated metal pipe was placed after that event (see Sheet 2 of Appendix A). To our knowledge, no cutoff trench or internal drainage features were incorporated. The owner indicated an awareness of the seepage along the downstream toe of the dam, which was noted during our inspection. To our knowledge, no other modifications have been made to the dam.

H. Normal Operating Procedure:

Normal flows will be passed by three corrugated metal pipes (two 12 in. diameter and one 15 in. diameter), which are located in the north abutment. According to the owner, these pipes come into operation mainly in the spring months. There is no emergency spillway.

1.5 PERTINENT DATA:

Pertinent data about the dam, appurtenant works, and reservoir are presented in the following paragraphs. Sheet 2 of Appendix A is a plan of the embankment and spillways with a typical cross section of the dam.

A. Drainage Area:

The drainage area for this dam, as obtained from the U.S.G.S. quad sheet, is equal to approximately 140 acres.

B. Elevations (Feet Above M.S.L.):

- (1) Top of Dam (measured): North End 778.3; Center 779.5; South End 784.0; Low Point 776.9.
- (2) Spillway Crest (inverts, corrugated metal pipes): Measured 775.0.
- (3) Pool on Date of Inspection: Measured 772.8.
- (4) Streambed: Estimated 731.4.
- (5) Maximum Tailwater: Unknown.

C. Discharge at Dam Site:

- (1) Discharge through the corrugated metal pipes in the north abutment is uncontrolled.
- (2) Estimated Discharge Capacity at Top of Dam (El. 776.9): 13 cfs.

D. Reservoir Surface Areas:

- (1) At Principal Spillway Crest: Estimated 15 acres.
- (2) At Top of Dam: Estimated 16 acres.

E. Storage Capacities:

- (1) At Principal Spillway Crest: Estimated 264 acre-ft.
- (2) At Top of Dam (El. 776.9): Estimated 293 acre-ft.

F. Reservoir Lengths:

- (1) At Principal Spillway Crest: 1500 ft.

G. Dam:

- (1) Type: Earth and Rock Fill.
- (2) Length at Crest: 440 ft.
- (3) Height: 45.5 ft.
- (4) Top Width: Varies - 15 ft to 40 ft.
- (5) Side Slopes: Varies - 1.25H:1V to 2.0H:1V.
- (6) Zoning: Earth and rock in downstream portion; silt and clay in upstream portion; no internal drainage.
- (7) Cutoff: None reported.

H. Spillway:

- (1) Location: North Abutment.
- (2) Type: Three corrugated metal pipes--two 12 in. diameter and one 15 in. diameter. Pipes are approximately 15 ft long and essentially level with inverts at approximate elevation 775.0. There is no emergency spillway.

SECTION 2 - ENGINEERING DATA

2.1 GENERAL:

No engineering data exist for this dam. No construction inspection records or documented maintenance and operation data exist to our knowledge.

2.2 DESIGN:

A. Surveys:

No detailed surveys have been made of this dam, to our knowledge. U.S.G.S. benchmark K-137, which is located as described on Sheet 2 of Appendix A, was used as datum to make our inspection survey of the dam (B.M. elev. = 739.68).

B. Geology and Subsurface Materials:

The general geology of the area indicates 5 ft to 10 ft of loess over a thin mantle of glacial till and residual materials in upland areas. Bedrock in the area consists of the Bowling Green dolomite member of the Edgewood Formation, the Saverton and Grassy Creek shales and the Louisiana limestones. No geology reports or boring logs were available for this dam.

C. Foundation and Embankment Design:

No design computations are available. Information from the owner and local residents indicates that the dam is composed of soil and boulders from a nearby rock quarry. A liner section along the entire upstream side of the dam is reported to consist of 20 ft of silts and clays from the abutment and reservoir areas. To our knowledge, no cutoff trench or internal drainage features were incorporated. No construction inspection records were obtained.

D. Hydrology and Hydraulics:

No hydrologic or hydraulic design data were obtained. Our analyses of the PMF and the 100-year flood are presented in Appendix B. These analyses were based on our field survey and observations and estimates of areas and volumes from the U.S.G.S. quad sheet (Bowling Green, 15 min., 1937). It was concluded that the structure will pass 10 percent of the Probable Maximum Flood without overtopping. The 100-year frequency flood will overtop the dam.

E. Structure:

No structural design computations were available.

2.3 CONSTRUCTION:

No construction inspection data have been obtained. The dam was constructed by the Bibb family in 1955. According to the owner, the two 12 in. corrugated metal pipes were installed at that time. After the dam was overtopped in 1973, the 15 in. CMP was installed (see Sheet 2 of Appendix A). No other modifications are known to exist.

2.4 OPERATION AND MAINTENANCE:

The owner indicated that the corrugated metal pipes come into service mainly in the spring. The appearance of the dam indicates that no regular maintenance is done.

2.5 EVALUATION:

No engineering data were available. Thus, a detailed assessment of the design, construction and operation could not be done. The owner should have an engineer experienced in the design of dams perform detailed seepage and stability analyses.

SECTION 3 - VISUAL INSPECTION

3.1 GENERAL:

The field inspection was made on 28 September 1978. The inspection team consisted of personnel from Anderson Engineering, Inc. of Springfield, Missouri and Hanson Engineers, Inc. of Springfield, Illinois. The team members were:

Louis Williams - Anderson Engineering (Instrument Man)
Steve Brady - Anderson Engineering (Civil Engineer)
Dave Daniels - Hanson Engineers (Geotechnical and Hydraulics Engineer)
Dan Kerns - Hanson Engineers (Geotechnical Engineer)

3.2 DAM:

The dam is an earth and rock fill embankment reportedly constructed from borrow obtained from a nearby rock quarry. According to a local resident, a 20 ft section of clay and silt from the abutment and reservoir areas was later placed along the entire upstream portion. This was placed after the initial embankment would not hold water.

The dam is covered with brush, small trees and some trees as large as 12 in. in diameter. Apparent seepage under the dam was noted along the north one-half to two-thirds of the downstream toe. The embankment appeared to be fairly dry except for an area at approximate station 2+20 where seepage was apparently coming through the embankment up to approximate elevation 760.6 (17 ft down from the crest). At one location on the downstream toe near the north abutment, seepage was evident at the base of a 12 in. diameter tree.

The seepage was manifested by pools of water and soft, spongy areas with growths of reeds and cattails (see photographs on Sheets 3 and 4 of Appendix C). No boils or obvious piping was evident. The owner indicated that the seepage has been evident for some years, and he was not aware of any noticeable increase in its intensity.

The downstream face of the embankment was quite steep (slopes ranging from 1.25H:1V to 2.0H:1V). Numerous animal burrows were noted along the downstream face. Erosional gullies were noted primarily at the south abutment-embankment contact.

The horizontal alignment appeared as constructed. No surface cracking or unusual movement was obvious. There was apparently no riprap on the upstream face.

No instrumentation (monuments, piezometers, etc.) was observed.

A. Spillway and Outlet:

The corrugated metal pipes appeared to be in fairly good condition, except for two which were slightly bent on one end. The inlet and outlet areas are overgrown with brush and weeds. The outlet channel is overgrown with brush. Some erosion was noted at the outlet end of the corrugated metal pipes. There was no riprap in this area.

3.5 RESERVOIR AND WATERSHED:

The immediate periphery of the lake is wooded with moderate slopes. No sloughing of the reservoir banks was noted. The watershed is primarily wooded with some pasture. It should be noted that a new roadway is planned to be constructed across the upper reaches of the Bibb Lake drainage area (see Sheet 1 of Appendix B). Depending on how the drainage is handled, this construction may somewhat affect the contributing drainage area and the runoff characteristics. Future analyses of this lake should take the planned new construction into account.

3.4 EVALUATION:

Trees and brush on the dam, animal burrows, erosion, and seepage are considered deficiencies. If these deficiencies are not corrected, they could lead to a serious potential of failure. An engineer experienced in the design and construction of dams should evaluate and recommend methods to correct and/or control these deficiencies. Remedial action is required in the very near future.

The owner has indicated that the seepage which was noted along the downstream toe of the dam has been occurring for some years. However, this condition could deteriorate rapidly and lead to a serious failure potential. This condition should be evaluated by an engineer experienced in the design and construction of dams and remedial action taken in the very near future.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES:

There are no controlled outlet works for this dam; therefore, no regulating procedures exist. The pool is controlled by rainfall, runoff, evaporation, and rather minimal capacity of the uncontrolled spillways.

4.2 MAINTENANCE OF DAM:

Based on the amount of brush and size of trees on the dam, it appears that it has been many years since the vegetation has been cut.

4.3 MAINTENANCE OF OPERATING FACILITIES:

No operating facilities exist at this dam.

4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT:

The inspection team is not aware of any existing warning system for this dam.

4.5 EVALUATION:

If the uncontrolled vegetation is allowed to continue, a serious potential of failure may develop. Erosional areas should be corrected and maintained. Animal burrows should be filled. The seepage condition should be evaluated by an engineer experienced in the design and construction of dams, and remedial action should be taken.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES:

A. Design and Experience Data:

No design data are available. The drainage area and the lake area were developed from the U.S.G.S. Bowling Green quadrangle. The spillway and dam layout are from surveys made during the inspection. Appendix B contains our overtopping analysis, which is based on U.S. Army Corps of Engineers guidelines.

B. Visual Observations:

The metal pipe spillways (see Sheet 2 of Appendix A) are in fairly good condition, except for two which are slightly bent on one end. Some erosion has taken place at the outlet end, and the outlet channel is overrun with brush. These conditions should be corrected. The owner has indicated that the corrugated metal pipes come into service mainly in the spring.

No facilities are available to draw down the pool. Normal spillway releases would not be expected to endanger the integrity of the dam, provided the erosional area in the outlet area is corrected.

C. Overtopping Potential:

Based on the hydrologic and hydraulic analysis as presented in Appendix B, the metal pipe spillways will pass 10 percent of the Probable Maximum Flood. The Probable Maximum Flood is defined as the flood discharge that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region. The recommended guidelines from the Department of the Army, Office of the Chief of Engineers, require that this structure (intermediate size with high downstream hazard potential) pass 100 percent of the PMF without overtopping. One hundred percent of the PMF will overtop the dam by 2.08 ft for a duration of 14.0 hours with a resultant peak outflow discharge of 2145 cfs (see Sheet 6 of Appendix B). The 100-year flood event will overtop the dam by .13 ft for a duration of 9 hours with a resultant peak outflow discharge of 31 cfs (see Sheet 8 of Appendix B).

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY:

A. Visual Observations:

Visual observations which could adversely affect the structural stability of this dam are discussed in Sections 3.2 and 3.4.

B. Design and Construction Data:

No design or construction data relating to the structural stability of the dam were found.

C. Operating Records:

No appurtenant structures requiring operation exist at this dam.

D. Post-Construction Changes:

To our knowledge, the only post construction change was the installation of the 15 in. diameter CMP after the dam was topped in approximately 1973.

E. Seismic Stability:

The structure is located in seismic zone 1, which is historically the least active zone in terms of occurrence and magnitude of earthquakes. The seismic loading prescribed for zone 1 is generally not critical for a well constructed earth dam of this size. However, considering the lack of field density control during construction and the possible weakened condition of the embankment due to seepage pressures, it is recommended that the prescribed zone 1 seismic loading be applied in the stability analyses recommended in Section 7.2.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 DAM ASSESSMENT:

A. General:

This Phase I inspection and evaluation should not be considered as being comprehensive since the scope of work contracted for is far less detailed than would be required for an in-depth evaluation of dams. Latent deficiencies, which might be detected by a totally comprehensive investigation, could exist.

B. Safety:

The following items were noted during the visual inspection which should be corrected or controlled: (1) seepage at the toe and through the embankment; (2) a thick cover of trees and brush; (3) erosion gullies on the south abutment; (4) animal burrows on the downstream face; and (5) erosion in the spillway outlet area and brush overgrowth in the outlet channel.

The dam will be overtopped by flows in excess of 10 percent of the Probable Maximum Flood and also by the 100-year flood. Overtopping of an earthen embankment could cause serious erosion and could lead to failure of the structure.

C. Adequacy of Information:

The conclusions in this report were based on construction and performance history as related by others, and visual observation of external conditions. The inspection team considers that these data are sufficient to support the conclusions herein. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency.

D. Urgency:

The remedial measures recommended in paragraph 7.2 should be accomplished in the very near future. If these items are not corrected and if good maintenance is not provided, the embankment condition will continue to deteriorate and may lead to a serious failure potential.

E. Necessity for Phase II:

Based on the result of the Phase I inspection, no Phase II inspection is recommended.

F. Seismic Stability:

The structure is located in seismic zone 1, which is historically the least active zone in terms of occurrence and magnitude of earthquakes. The seismic loading prescribed for zone 1 is generally not critical for a well-constructed earth dam of this size. However, considering the lack of field density control during construction and the possible weakened condition of the embankment due to seepage pressures, it is recommended that the prescribed zone 1 seismic loading be applied in the stability analyses recommended in Section 7.2.

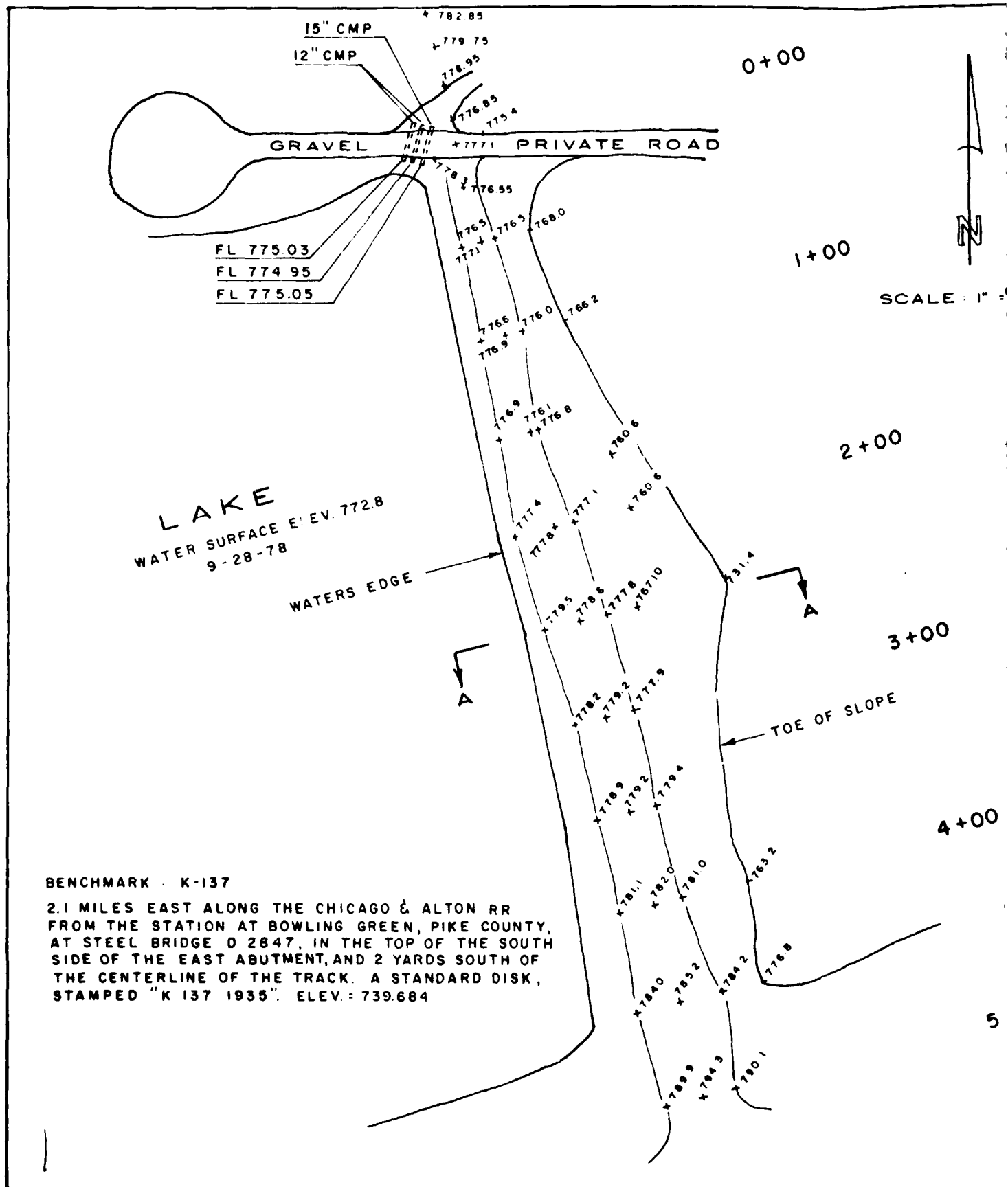
7.2 REMEDIAL MEASURES:

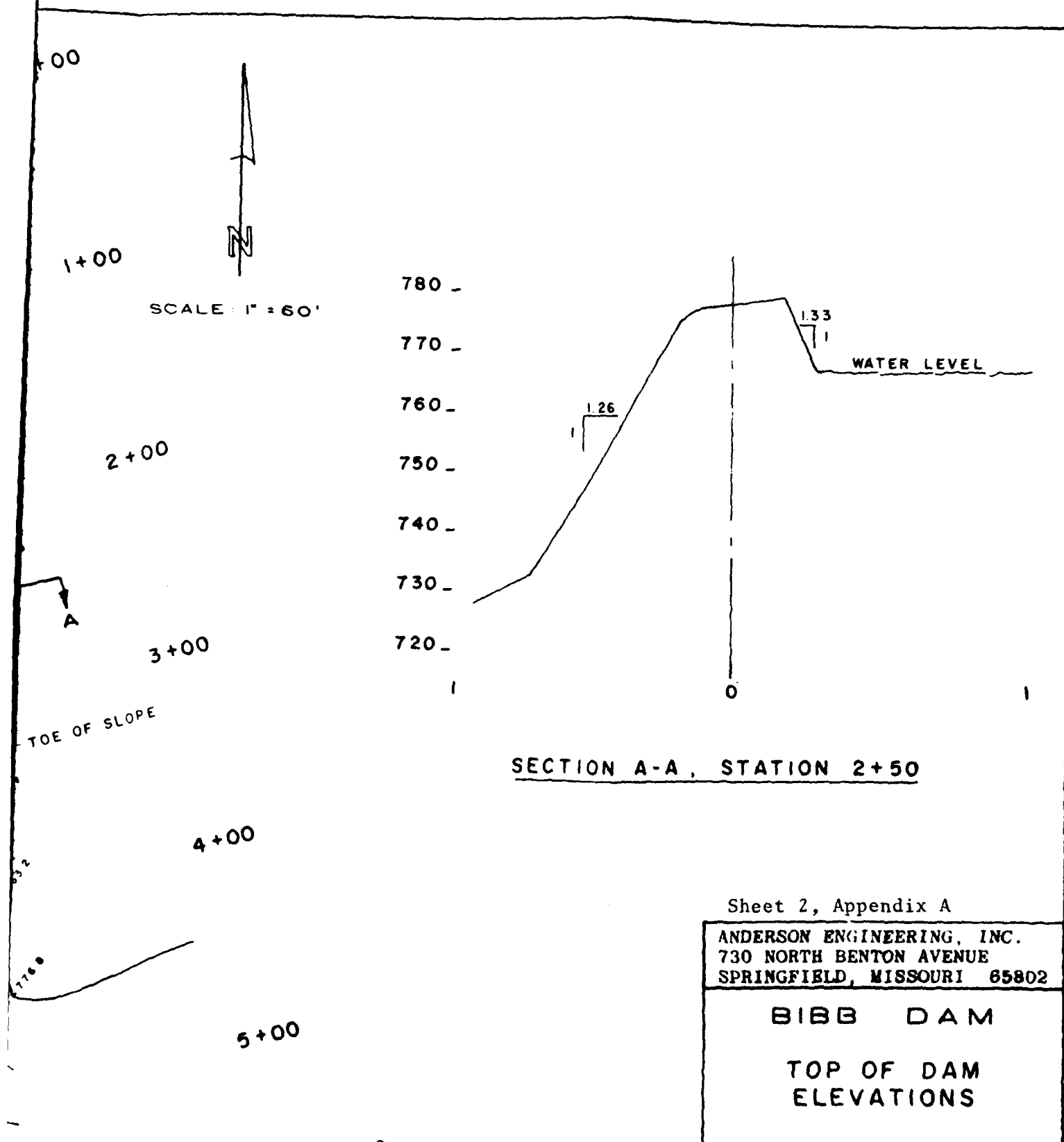
The following remedial measures and maintenance procedures are recommended. All remedial measures should be performed under the guidance of a professional engineer experienced in the design and construction of dams.

- (1) The seepage which was noted at the downstream toe and through the embankment at station 2+20 should be evaluated in the very near future by an engineer experienced in the design of dams, and remedial action should be taken.
- (2) Tree growth on the dam is considered a deficiency and should be removed under the direction of a competent engineer. Indiscriminate clearing methods could jeopardize the safety of the dam.
- (3) Animal burrows should be filled.
- (4) Erosional areas on the south abutment should be regraded. Future erosion can possibly be minimized with the use of riprap.
- (5) The area below the spillway outlet pipes should be riprapped to prevent future erosion and undermining. The outlet channel area should be cleared.
- (6) The downstream slope should be checked periodically for seepage and stability problems. If wet areas or seepage flows are observed, or if sloughing is noted, then the dam should be inspected immediately, and the situation should be evaluated by an engineer experienced in design and construction of dams.

- (7) After deficiencies are remedied, a detailed inspection of the dam should be made periodically by an engineer experienced in the design and construction of dams. More frequent inspections may be required if new slides, seeps, or other items of distress are observed.
- (8) The spillway size and height of dam should be increased to pass the PMF. In either case, the spillway should be protected to prevent erosion.
- (9) Seepage and stability analyses comparable to the requirements of the guidelines were not available, which is considered a deficiency and should be corrected.

APPENDIX A





Sheet 2, Appendix A

ANDERSON ENGINEERING, INC.
730 NORTH BENTON AVENUE
SPRINGFIELD, MISSOURI 65802

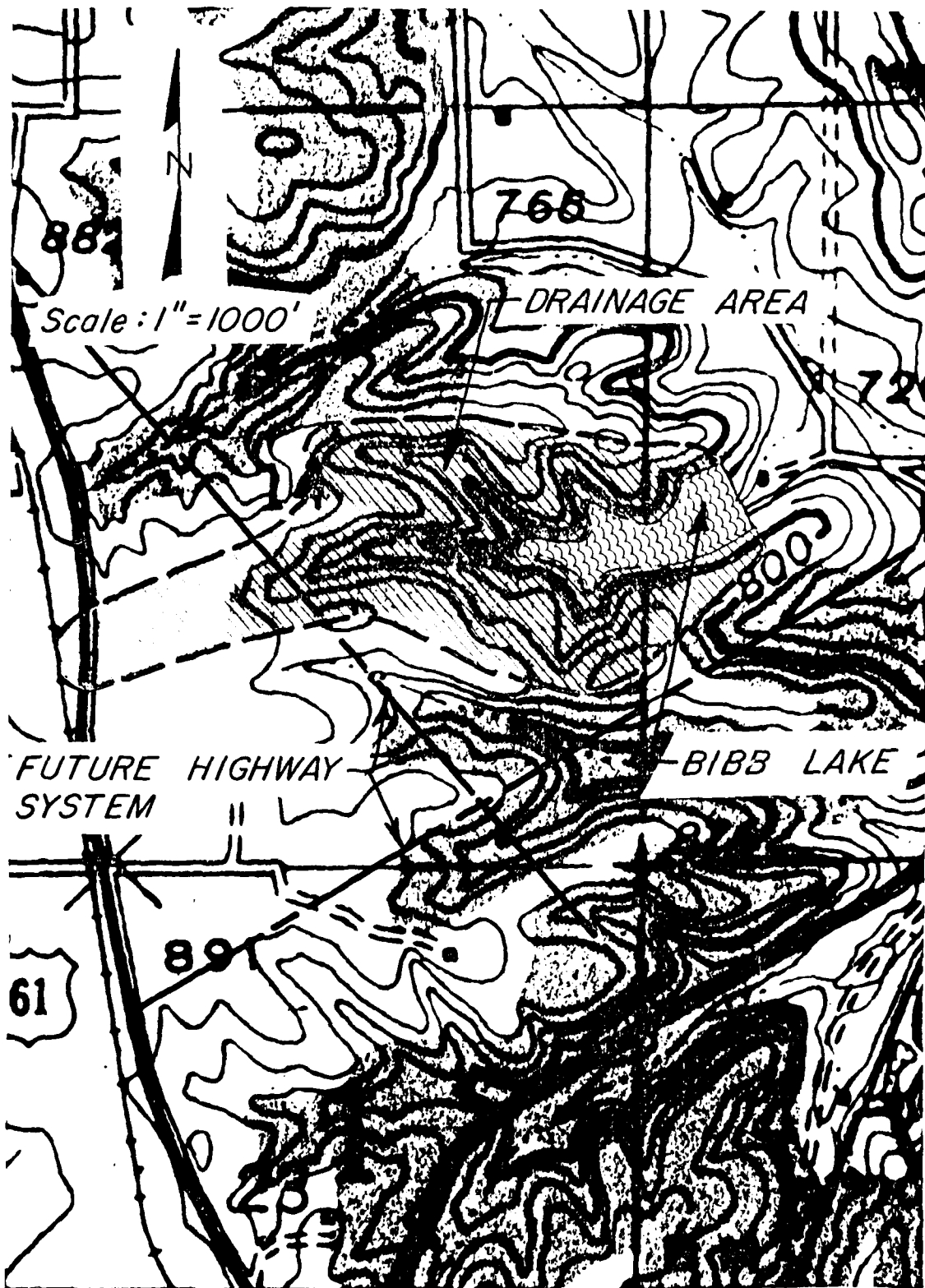
BIBB DAM

TOP OF DAM
ELEVATIONS

MO. 10231

2

APPENDIX B



Sheet 1, Appendix B

HYDRAULIC AND HYDROLOGIC DATA

Design Data: From Field Measurements and Computations

Experience Data: No records are available. The apparent high water mark was about 2.5 ft above the present level of the lake. According to the owner, the dam was overtopped in 1973. The owner said also that the two 12 in. diameter corrugated metal pipes were installed when the dam was built and that a 15 in. diameter pipe was placed after the dam was overtopped in 1973. These three pipes act as the only spillway for the dam. They are located in the north abutment under a private road. The owner said that these pipes operate generally during the period of spring runoff.

Visual Inspection: At the time of inspection, the pool was at elevation 772.8, which is 2.2 ft below normal pool (elevation 775.0).

Overtopping Potential: Flood routings were performed to determine the overtopping potential. Since the dam is of intermediate size with a high hazard rating, a spillway design storm of 100 percent Probable Maximum Flood was prescribed by the guidelines. The PMF is defined by the guidelines as the flood discharge that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region. The watershed drainage and the reservoir surface areas were obtained by planimeter from the U.S.G.S. 15 min. Bowling Green, Mo.-Ill. quadrangle map. The storage volume was developed from this data.

A 5 minute interval unit graph was developed for this watershed which resulted in a peak inflow of 502 c.f.s. and a time to peak of 10 minutes. Application of the probable maximum precipitation, minus losses resulted in a flood hydrograph peak inflow of 2618 c.f.s. Rainfall distribution for the 24 hour storm was according to EM 1110-2-1411.

The crest elevation of the dam varies considerably. For a more realistic overtopping analysis, the existing shape of the crest of the dam, obtained by survey, was used in the computation of the rating curve for the dam. Considering the top of the dam at the lowest point of the crest (El. 776.90), the combination of dam, spillway and storage is not sufficient to pass the PMF, (nor the 100 yr. flood) without overtopping the embankment. The PMF would overtop the crest of the dam by 2.08 ft (El. 778.98).

Fifty percent of the PMF was routed through the spillway, resulting in an overtopping of 1.29 ft (pool elev. 778.19). The portion of the PMF that will just reach the top of dam is about 10 percent which is also less than the 100 yr. flood event. The 100 yr. flood was also routed through the spillway, resulting in an overtopping of 0.13 ft (elev. 777.03). The discharge capacity of the spillway (3 CMP pipes at elevation 775) is very minimal. For additional information see the Summary of Dam Safety Analyses on Sheets 3 and 4.

OVERTOPPING ANALYSIS FOR Bibb Lake Dam

INPUT PARAMETERS

1. Unit Hydrograph - SCS Dimensionless - Flood Hydrograph Package (HEC-1); Dam Safety Version Was Used.
Hydraulic Inputs Are As Follows:
 - a. Twenty-four Hour Rainfall of 25 Inches For 200 Square Miles - All Season Envelope
 - b. Drainage Area = 140 Acres; = 0.22 Sq. Miles
 - c. Travel Time of Runoff 0.26 Hrs.; Lag Time 0.16 Hrs.
 - d. Soil Conservation Service Runoff Curve No. 80 (AMC III)
 - e. Proportion of Drainage Basin Impervious 0.11
2. Spillways
 - a. Primary Spillway: Two 12" Ø and one 15" Ø pipe
(Invert EL. 775)
 - b. Emergency Spillway (None)
Length - Ft.; Side Slopes -; C = -
 - c. Dam Overflow
Length varies Ft.; Side Slopes irregular, C = 5.0

Note: Combined Spillway and Dam Rating Curve Prepared by Hanson Engineers. Data Provided to Computer on Y4 and Y5 Cards.

SUMMARY OF DAM SAFETY ANALYSIS

1. Unit Hydrograph
 - a. Peak - 502 c.f.s.
 - b. Time to Peak 10 Min.
2. Flood Routings Were Computed by the Modified Puls Method
 - a. Peak Inflow (see Sheet 6 Appendix B)
50% PMF 1309 c.f.s.; 100% PMF 2618 c.f.s.

b. Routed Peak Elevation

50% PMF 778.19 100% PMF 778.98

c. Portion of PMF That Will Reach Top of Dam

10 %; Top of Dam Elev. (varies) 776.90 Ft. (Lowest Point)

3. Computer Input and Output Data Sheets for the PMF and 100 Yr. Flood are shown in Sheets 5, 6, 7 and 8.

LAKE DAN PROBABLE

OVERTOPPING

COUNTY CODE

HANSON ENGINEERS

INSPECTOR NO. 100 #03778

300

5

10 0.12 0.15 0.20 0.40 0.50 0.80 1.00

0 1 0 0 1

INFLOW HYDROGRAPH

1 2 75 72 1
0 25 100 100 70

-1 -30

0 11

0.16

-1

2

RESERVOIR ROLL

AT RICH TAN (PRIMARY) OUTLET PIPES

1 264 -1

776 776 776 776 776 776

0 8 74 74 74 74 74 74

0 264 265 300 301 390 391

772 775 777 778 781 783

775

10 776 9

99

14 B1EE

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47 OUTLE 11500

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Sheet 5 of Appendix B

2

6188 LAKE DAM - PROBABLE MAXIMUM FLOOD - 1967

PEAK FLOW AND STORAGE (END OF 1967) SUMMARY FOR MULTIPLE PLAN-RATIO
 FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER
 AREA IN SQUARE FEET (SQUARE KILOMETERS))

OPERATION	STATION	AREA	PLAN RATIO	RATIOS APPLIED TO F			
				1 0.10	2 0.12	3 0.15	4 0.20
PROGRAPH AT	1	1.01	1.00	1.14	393	524	
				1.20	11.12	14.83	
ROUTED TO	2	1.01	1.00	1.47	107	293	
				1.54	3.03	8.31	

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1	INITIAL VALUE	SPILLWAY CREST
ELEVATION	775.00	775.00
STORAGE	264	264
OUTFLOW	0.	0.

RATIO OF PMF	MAXIMUM RESERVOIR U.S. ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER HOURS
0.10	776.87	0.00	293	13	0
0.12	777.05	0.15	296	47	5
0.15	777.14	0.24	297	107	6
0.20	777.42	0.52	302	293	7
0.40	778.00	1.10	311	685	11
0.50	778.19	1.29	315	974	12
0.80	778.68	1.73	323	1696	12
1.00	778.98	2.03	328	2145	14



FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
AND (CUBIC METERS PER SECOND)
(SQUARE KILOMETERS)

RATIOS APPLIED TO FLOWS

RATIO 3	RATIO 4	RATIO 5	RATIO 6	RATIO 7	RATIO 8
0.15	0.20	0.40	0.50	0.80	1.00
393.	524.	1047.	1309.	2094.	2618.
11.12%	14.83%	29.65%	37.06%	59.30%	74.13%
107.	243.	685.	974.	1696.	2145.
3.03%	3.31%	19.39%	27.58%	43.03%	60.73%

DAM SAFETY ANALYSIS

SPILLWAY CREST	TOP OF DAM
775.00	776.90
264	293.
0	13.

MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
13.	0.00	18.92	0.00
47.	5.25	18.00	0.00
107.	6.42	16.17	0.00
293.	7.50	15.92	0.00
685.	11.50	15.92	0.00
974.	12.00	15.83	0.00
1696.	12.92	15.83	0.00
2145.	14.00	15.83	0.00

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THE DAN - 100YRS FLOOD

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Sheet 7 Appendix B

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781 785

7004 15049

392

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LAKE DAM - 100

PEAK FLOW

FOR MILLER & DUN PATI
PER SECOND (CUB) METERS PER
AREA IN SQUARE MILES (SQUARE KILOMETERS)

RATIOS APPLIED TO FLO

SECTION	STATION	DATE	PLAN	RATIO	1
				1.00	
PHOTOGRAPH AT				1.00	
				1.00	
				1.00	

SUMMARY OF DAM SAFETY ANALYSIS

AN

AT	IN	VALUE	SPILLWAY CREST
AT	IN	VALUE	75.00
AT	IN	VALUE	264
AT	IN	VALUE	0

RATIO OF PMF	MAXIMUM RESERVOIR W.S. ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURAT OVER HOUR
1.00	777.03	0.13	295	31	9.0

RATIO ECONOMIC COMFORT ONE
 SECOND (CUBIC METERS PER SECOND
 PER SQUARE KILOMETERS)

RATIOS APPLIED TO FLOWS

1. DAM SAFETY ANALYSIS

SECTOR	AS	TOP OF DAM
776	90	
293		
13		

MAX	MAX	DURATION	TIME OF	TIME OF
OUT	OUT	OVER TOP	MAX OUTFLOW	FAILURE
FEET	CFS	HOURS	HOURS	HOURS
295	31	9 08	15.00	0 00

APPENDIX C



Aerial Views of Lake and Dam



View of Crest From North Abutment - Looking South



View of Crest From South Abutment - Looking North



Upstream Face - Looking South



Downstream Face - Looking West From Floodplain



Seepage Area - At Toe Near North Abutment



Seepage Area - At Toe Near Center of Dam



Entrance Corrugated Metal Pipes - Spillway



Outlet End - Corrugated Metal Pipes-Spillway



Outlet Channel - Looking Upstream



Outlet Channel - Looking Downstream



View of Lake From North Abutment

Sheet 7
Appendix C

DATE
FILMED
— 8